



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/501,440	07/13/2004	Moeketsi Mpholo	04-571	9394
7590	10/04/2005		EXAMINER	
McDonnell Boehnen Hulbert & Berghoff 300 South Wacker Drive 32nd Floor Chicago, IL 60606			NOGUEROLA, ALEXANDER STEPHAN	
			ART UNIT	PAPER NUMBER
			1753	

DATE MAILED: 10/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/501,440	MPHOLO ET AL.	
	Examiner	Art Unit	
	ALEX NOGUEROLA	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on preliminary amndt. of 7/13/2004.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-15 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 13 July 2004 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 3/17/2005.
- 4) Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) Notice of Informal Patent Application (PTO-152)
- 6) Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 5, 7, 8, and 11 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention:

- a) Claim 5, line 2: -- equal – should be inserted between “width” and ‘to’.
- b) Claim 7: what is the scope of “elements”? Does this term include organic and inorganic objects of any size?
- c) Claim 7: what is the scope of “semiconductor components”? Are Applicants actually claiming using the apparatus to move transistors, capacitors, and microchip wafers in a fluidic stream?
- d) Claim 8: what is meant by driving a micromachine?
- e) Claim 11, line 5: “a” should be – the --.

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claim 7 is rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for moving and mixing chemicals and biological substances, does not reasonably provide enablement for moving semiconductor components such as transistors, capacitors, and microchip wafers, or more broadly "elements." The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to configure and use the invention commensurate in scope with these claims. Now, applying the "Wands" factors

a) The breadth of claim 7 is quite broad in a sense since the term "semiconductor element" actually encompasses a variety of materials of varying size, shape and compositions. As noted above, for example, transistors, capacitors, and microchip wafers can be construed as semiconductor elements.

b) The nature of the apparatus of unclear. The preamble to Claim 1 states that the apparatus is for driving small volumes of fluid. This does not appear to be consistent with moving semiconductor elements as required by claim 7.

c) at the time of the invention it was known to apply an alternating voltage to interlaced electrodes to move substances at the molecular and cellular level,

such as DNA and cells, and small polymer beads, but not larger inorganic objects such as microchip wafers.

d) the level of one with ordinary skill in the art would be quite high as the device is a high technology apparatus.

e) there is some predictability in the art for certain classes of substances such as nucleic acids and cells.

f) no direction is provided by the inventors on how one is to configure the apparatus of claim 1 to move semiconductor components or any element other chemicals and biological substances.

g) no working examples are provided on moving semiconductor components or elements other than chemicals and biological substances.

h) a significant amount of experimentation would be necessary to configure the apparatus of claim 1 to move elements, such as semiconductor components, as claimed.

5. Claim 8 is rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for moving and mixing chemicals and biological

substances, does not reasonably provide enablement for driving a micromachine. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to configure and use the invention commensurate in scope with these claims. Now, applying the "Wands" factors

- a) The breadth of claim 7 is quite broad as the expression "to drive a micromachine" could mean somehow powering, propelling, or controlling a micromachine. Furthermore, the expression is also broad as the term "micromachine" is itself broad.
- b) The nature of the apparatus of unclear. The preamble to Claim 1 states that the apparatus is for driving small volumes of fluid. This does not appear to be consistent with driving a micromachine as required by claim 8.
- c) at the time of the invention it was known to apply an alternating voltage to interlaced electrodes to move substances at the molecular and cellular level, such as DNA and cells, and small polymer beads, but not to power, propel, or control a micromachine.
- d) the level of one with ordinary skill in the art would be quite high as the device is a high technology apparatus.

- e) there is some predictability in the art for certain classes of substances such as nucleic acids and cells.
- f) no direction is provided by the inventors on how one is to arrange the apparatus of claim 1 to drive a micromachine.
- g) no working examples are provided on driving a micromachine.
- h) a significant amount of experimentation would be necessary to arrange the apparatus of claim 8 to drive a micromachine as claimed.

Claim Objections

6. Claims 12 and 13 are objected to because of the following informalities:
 - a) Claim 12: in line 2 "claims" should be – claim -- . Appropriate correction is required.
 - b) Claim 13, line1: "apparatus" should be deleted.
 - c) Claim 13, line 4: the comma sifter "which" should be deleted.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1, 2, 4, 6, 9, and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Studer et al. ('Fabrication of micro fluidic devices for AC electrokinetic fluid pumping," *Microelectronic Engineering* 61-62 (2002) 915-920) ('Studer"). Note that the requirements of 35 U.S.C. 371 were met on July 13, 2004. See the Notice of Acceptance of Application under 35 U.S.C. 371 and 37 CFR 1.495. The Studer article was published in July 2002. Thus the Studer article was published more than one year prior to the effective filing date of the instant application and qualifies as prior art under 35 U.S.C. 102(b). United Kingdom patent application 0200705 from which Applicants also claim priority cannot be used to overcome a rejection under 35 U.S.C. 102(b). See MPEP 2133.02.

Addressing claims 1 and 13, for the limitations of this claim see the abstract; Figures 1 and 4; and the last two sentences of the bottom paragraph on page 918 bridging to page 919.

Addressing claim 2, the additional limitation of this claim is implied by Figure 4a, which shows the effects of different applied frequencies on fluid velocity.

Addressing claim 4, as a first matter is not clear that claim 4 further structurally limits the apparatus of claim 1. It only appears to indicate an intended use. In any event, using the electrode arrays to perform mixing is disclosed by Studer. See the Conclusion.

Addressing claim 6, the additional limitation of this claim is implied by the Experimental section on pages 916-917, which discloses CMOS techniques, such as lithography. Furthermore, how the apparatus I made is a product-by-process limitation that does not patentably distinguish the claimed apparatus from that of Studer unless a material difference can be shown the two apparatuses.

Addressing claim 9, Studer discloses using the apparatus to separate biomolecules. See the Conclusion on page 920.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

Art Unit: 1753

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

11. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

12. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Studer et al. ('Fabrication of micro fluidic devices for AC electrokinetic fluid pumping," *Microelectronic Engineering* 61-62 (2002) 915-920) ('Studer") in view of Fuhr et al. (US 6,113,768) ("Fuhr") and Schnelle et al. (Adhesion Inhibited Surfaces. Coated and Uncoated Interdigitated Electrode Arrays in the Micrometer and Submicrometer Range," *Langmuir* 1996, 12, 801-809) ('Schnelle")0. Note that the requirements of 35 U.S.C. 371

were met on July 13, 2004. See the Notice of Acceptance of Application under 35 U.S.C. 371 and 37 CFR 1.495. The Studer article was published in July 2002. Thus the Studer article was published more than one year prior to the effective filing date of the instant application and qualifies as prior art under 35 U.S.C. 103(a). United Kingdom patent application 0200705 from which Applicants also claim priority cannot be used to overcome a rejection under 35 U.S.C. 103(a). See MPEP 2133.02.

Studer discloses an apparatus as set forth in claim 1. See the abstract; Figures 1 and 4; and the bottom paragraph on page 918 bridging to page 919. Studer does not mention providing an insulator over at least a portion of one or both of the electrode arrays. Fuhr discloses providing an insulator over dielectrophoresis electrodes. See the abstract and Figure 2. It would have been obvious to one with ordinary skill in the art at the time of the invention to provide an insulator over at least a portion of one or both of the electrode arrays as taught by Fuhr in the invention of Studer because as taught by Fuhr then the adhesion properties of fluid components to the electrodes can be better controlled. As disclosed by Schnelle adhesion of particles and cells to electrode surfaces reduce their lifetimes and accuracy. See the Introduction. Additionally, electrolytic processes are prevented so that the electrode arrays can be used in physiological solutions of high conductivity. See the abstract; col. 3:30-42; and col. 4:29-47.

13. Claims 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Studer et al. ('Fabrication of micro fluidic devices for AC electrokinetic fluid pumping,' *Microelectronic Engineering* 61-62 (2002) 915-920) ('Studer') in view of Pethig et al. (WO 97/34689 A1) ('Pethig'). Note that the requirements of 35 U.S.C. 371 were met on July 13, 2004. See the Notice of Acceptance of Application under 35 U.S.C. 371 and 37 CFR 1.495. The Studer article was published in July 2002. Thus the Studer article was published more than one year prior to the effective filing date of the instant application and qualifies as prior art under 35 U.S.C. 103(a). United Kingdom patent application 0200705 from which Applicants also claim priority cannot be used to overcome a rejection under 35 U.S.C. 103(a). See MPEP 2133.02.

Studer discloses an apparatus as set forth in claim 1. See the abstract; Figures 1 and 4; and the bottom paragraph on page 918 bridging to page 919. Studer does not mention providing more than one apparatus according to claim 1 in combination to define a cavity therebetween, or for drawing fluids, mixing them, and pumping them or for performing a reaction. However, Studer does disclose that their apparatus may be used for "injection, mixing and separation of bio-molecules." See the Conclusion on page 920. Furthermore, providing more than one apparatus as disclosed by Studer is obvious because it is just multiplication of parts for multiplied effect. Pethig discloses an apparatus "for carrying out chemical, physical or physico-chemical reactions between particles suspended in a liquid medium." The apparatus comprises several dielectrophoresis apparatuses, which may be combined to create a complex processing scheme. See the abstract. In light of Pehtig, claims 10-12 are just combining two or

more apparatuses of Studer to two or more separations, reactions, or other processing stages. As for a light source and a filtered optoelectrical detector. Note that Studer discloses optical microscopy. See the abstract.

14. Claims 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Studer et al. ('Fabrication of micro fluidic devices for AC electrokinetic fluid pumping," *Microelectronic Engineering* 61-62 (2002) 915-920) ('Studer") in view of Batchelder (US 4,390,403). Note that the requirements of 35 U.S.C. 371 were met on July 13, 2004. See the Notice of Acceptance of Application under 35 U.S.C. 371 and 37 CFR 1.495. The Studer article was published in July 2002. Thus the Studer article was published more than one year prior to the effective filing date of the instant application and qualifies as prior art under 35 U.S.C. 103(a). United Kingdom patent application 0200705 from which Applicants also claim priority cannot be used to overcome a rejection under 35 U.S.C. 103(a). See MPEP 2133.02.

Addressing claim 14, Studer discloses an apparatus as set forth in claim 13. See the abstract; Figures 1 and 4; and the bottom paragraph on page 918 bridging to page 919. Although Studer discloses mixing (see the Conclusion on page 920), Studer does not mention how mixing is accomplished, particularly by driving a fluid in two opposite directions. Batchelder discloses an apparatus and method for manipulating chemicals using interlaced dielectrophoresis electrodes to, for example mix and react them. See the abstract and Figures 6 and 6A. Batchelder further discloses mixing different solutions by driving a fluid in two opposite directions. See col. 8:51-64. it would have

been obvious to one with ordinary skill in the art at the time of the invention to mix a fluid as taught by Batchelder in the invention of Studer because the mixing method of Batchelder is a very simple way to perform mixing.

Addressing claim 15, although Studer does not mention providing fluid from at least two supply ports this is obvious if mixing of two solutions is to be performed. As for an illuminating light source and an opto-electrical detector, note that Studer discloses optical microscopy (see the abstract) and Batchelder also discloses optical monitoring of the mixing (col. 8:64-66)

Priority

15. It is noted that this application appears to claim subject matter disclosed in prior Application No. PCT/GB03/00082, filed January 14, 2003. A reference to the prior application must be inserted as the first sentence(s) of the specification of this application or in an application data sheet (37 CFR 1.76), if applicant intends to rely on the filing date of the prior application under 35 U.S.C. 119(e), 120, 121, or 365(c). See 37 CFR 1.78(a). For benefit claims under 35 U.S.C. 120, 121, or 365(c), the reference must include the relationship (i.e., continuation, divisional, or continuation-in-part) of all nonprovisional applications. If the application is a utility or plant application filed under

35 U.S.C. 111(a) on or after November 29, 2000, the specific reference to the prior application must be submitted during the pendency of the application and within the later of four months from the actual filing date of the application or sixteen months from the filing date of the prior application. If the application is a utility or plant application which entered the national stage from an international application filed on or after November 29, 2000, after compliance with 35 U.S.C. 371, the specific reference must be submitted during the pendency of the application and within the later of four months from the date on which the national stage commenced under 35 U.S.C. 371(b) or (f) or sixteen months from the filing date of the prior application. See 37 CFR 1.78(a)(2)(ii) and (a)(5)(ii). This time period is not extendable and a failure to submit the reference required by 35 U.S.C. 119(e) and/or 120, where applicable, within this time period is considered a waiver of any benefit of such prior application(s) under 35 U.S.C. 119(e), 120, 121 and 365(c). A benefit claim filed after the required time period may be accepted if it is accompanied by a grantable petition to accept an unintentionally delayed benefit claim under 35 U.S.C. 119(e), 120, 121 and 365(c). The petition must be accompanied by (1) the reference required by 35 U.S.C. 120 or 119(e) and 37 CFR 1.78(a)(2) or (a)(5) to the prior application (unless previously submitted), (2) a surcharge under 37 CFR 1.17(t), and (3) a statement that the entire delay between the date the claim was due under 37 CFR 1.78(a)(2) or (a)(5) and the date the claim was filed was unintentional. The Director may require additional information where there is a question whether the delay was unintentional. The petition should be addressed to: Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

If the reference to the prior application was previously submitted within the time period set forth in 37 CFR 1.78(a), but not in the first sentence(s) of the specification or an application data sheet (ADS) as required by 37 CFR 1.78(a) (e.g., if the reference was submitted in an oath or declaration or the application transmittal letter), and the information concerning the benefit claim was recognized by the Office as shown by its inclusion on the first filing receipt, the petition under 37 CFR 1.78(a) and the surcharge under 37 CFR 1.17(t) are not required. Applicant is still required to submit the reference in compliance with 37 CFR 1.78(a) by filing an amendment to the first sentence(s) of the specification or an ADS. See MPEP § 201.11.

Allowable Subject Matter

16. Claim 5 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

17. The following is a statement of reasons for the indication of allowable subject matter:

a) Claim 5: the combination of limitations requires "a third set of electrodes having a width [equal] to that of the first set, interlaced with the second set of electrodes and separated from the first set by an insulator." Studer only provides two sets of electrodes.

Other Relevant Prior Art

18. In Tautsumi et al. (EP 0957576 A2) the first array of conductive electrodes and the second array of conductive electrodes each consists of spaced pairs of electrode fingers. See the abstract and Figure 1. One electrode of each pair of electrode fingers is a wide electrode and the other electrode of the pair of electrode fingers is a narrow electrode. The first array of conductive electrodes and the second array of conductive electrodes are identical except that the fingers are oriented in opposite directions, so the wide finger of an electrode pair in the first conductive array has the same width as a wide finger in an electrode pair in the second conductive array. Likewise, the narrow finger of an electrode pair in the first conductive array has the same width as a narrow finger in an electrode pair of a second conductive array.

Independent claims 1 and 13 require "that each of the electrodes in the second array has a width in a fluid driving direction which is greater than that of each of the electrodes in the first array [emphasis added]." In contrast, in Tautsumi et al. while the wide electrodes of the second array are wider than the narrow electrodes of the first conductive array they are not wider than the wide electrodes of the first conductive array.

Also, the narrow electrodes of the second conductive array are not wider than either the narrow or wide electrodes of the first array. Furthermore, the apparatus of Tautsumi et al. is directed to a surface wave acoustic device. The electrode dimensions are selected to optimize the generation of a surface acoustic wave. See paragraph [0014]. So it is not apparent that arrays of electrodes in Tautsumi have widths and "thickness selected such that, in use, by varying the peak value of an alternating drive voltage applied thereto the direction of flow of a fluid adjacent to the arrays of electrodes can be controlled" as stated in claim 1.

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALEX NOGUEROLA whose telephone number is (571) 272-1343. The examiner can normally be reached on M-F 8:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, NAM NGUYEN can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1753

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Alex Noguerola

Primary Examiner

AU 1753

September 30, 2005